Islamic University of Gaza
Engineering Hydrology
ECIV 4323
Second Semester (2014-2015)
Allowable time 60 minutes

Instructors:
Dr. Yunes Mogheir
Eng. Wael Salem
Eng. Doaa Safi

CLOSED BOOK EXAM

Student Name:

Q1	6	6
Q2	9	9
Q3	6	6
Q4	9	9
Total	30	30

Question 1: **(6 Marks)** 6

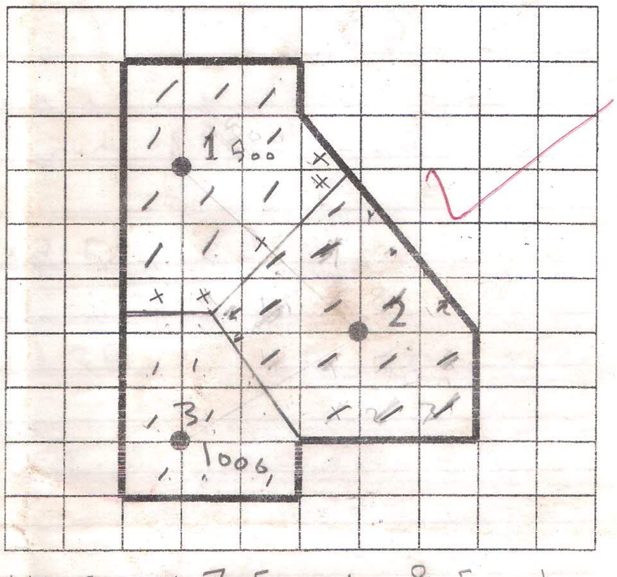
The average annual rainfall at gauges 1, 2 and 3 are 500, 750 and 1000 mm respectively.

1) Calculate the annual average rainfall quantity inside the given catchment using **Thiessen method.** NB: Each square is **1 Km x 1 Km.**
2) If the runoff coefficient = 0.65, What is the **value of losses** from marked catchment. Also, **What are the components of losses ?**

$A_1 = 13.3$

$A_2 = 14.2$

$A_3 = 8.5$



$P = \frac{13.3 \times 500 + 14.2 \times 750 + 8.5 \times 1000}{13.3 + 14.2 + 8.5} = 716.6$ mm

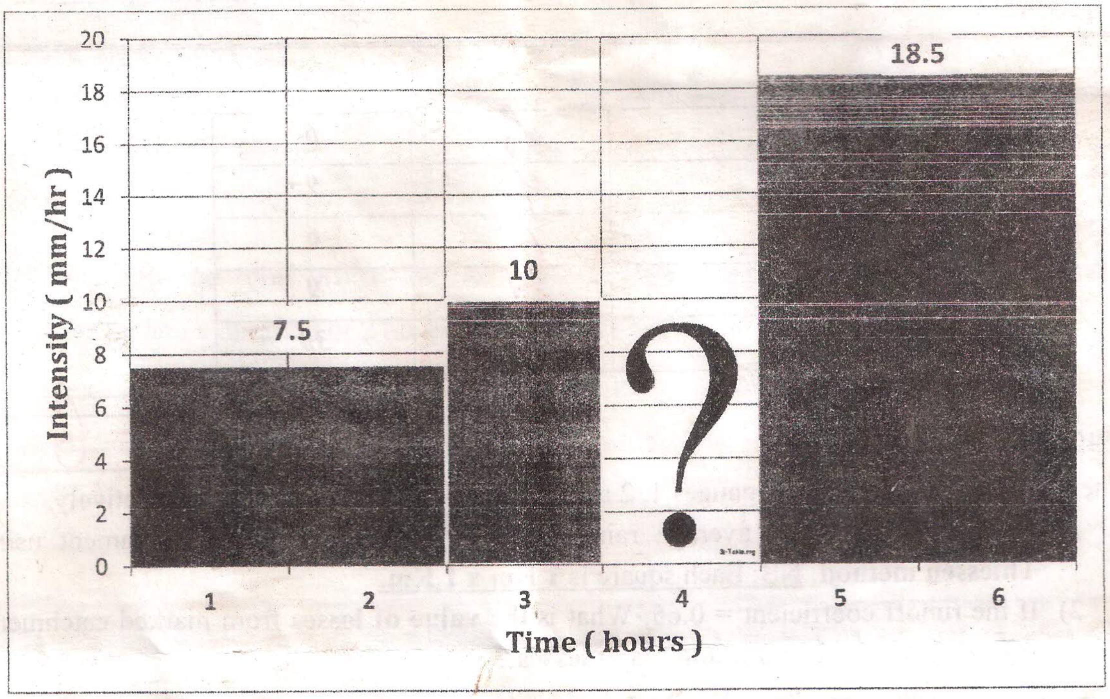
Loses = 0.35 x 716.6 = 250.81 mm ⟹ 9029160 m^3

loses component infiltration, transpiration, evaporation
depression

Question 2: (9 Marks) 9

A 6-hour storm resulted in **33 mm** direct runoff. The intensity in **the Forth period** was unrecorded . **However**, the total losses generated from this equaled **50 mm**.

1) Find out the missing intensity value ?
2) Find out the Φ index value ?



L = 50

R = 33

P = 50 + 33 = 83 mm

$I_{missing} = \frac{83 - (7.5\times2 + 10\times1 + 18.5\times2)}{1} = 21$ mm/hour

trial 1

$\phi = \frac{50}{6} = 8.33 > 7.5$ (Not ok)

trial 2

$\phi = \frac{50 - 7.5\times2}{4} = 8.75 < 10$ (ok)

check

$= (10-8.75) + (21-8.75) + (18.5-8.75)\times2 = 33$ mm ok

Question 3: **(6 Marks)** 6

A one-day rainfall of of **5 cm** at Gaza city was found to have **a return period of 50 years.** Determine the probability of a one-day rainfall equal to or greater than 5 cm at Gaza city, **will occure:**

1) Exactly once in 25 successive years.
2) At least twice in 25 successive years.

n year

r times

$$P_{r,n} = {}^{n}C_{r} P^{r} q^{n-r} = \frac{n!}{(n-r)!r!} P^{r} q^{n-r}$$

$P = \frac{1}{50} = 0.02$

$q = 1 - 0.02 = 0.98$

$P_{25,1} = \frac{25!}{(25-1)!\,1!} \times 0.02^{1} \times 0.98^{25-1} = 0.307$

$P_{25,0} = \frac{25!}{25!\,0!} \times 0.02^{0} * 0.98^{25} = 0.603$

$P_{\text{at least twice in } 25} = 1 - P_{25,0} - P_{25,1} = 1 - 0.603 - 0.307 = 0.09$

Question 4: **(9 Marks)** 9

A soil has Horton infiltration parameters $f_o = 110$ mm/hr, $f_c = 20$ mm/hr **and** k = 1.8 .

$$fp = fc + (fo - fc) \cdot e^{-kt} \qquad F = fc \cdot t + \frac{(fo - fc)}{k} \cdot (1 - e^{-kt})$$

1) Compute the **total infiltration** and **runoff** from a storm with an intensity of 15 mm/hr and a duration of 2 hours.

(infilaration) $F = 20 \times 2 + \frac{(110-20)}{1.8}(1 - e^{-1.8 \times 2}) = 88.63$ mm

$R = 15 \times 2 - 88.63 = -58.63$ mm / So $F = 30$ mm, $R = 0$ mm

2) Compute the **total infiltration** and **runoff** from a storm with an intensity of 100 mm/hr and a duration of 2 hours.

$F = 88.63$ mm

$R = 100 \times 2 - 88.63 = 111.37$ mm

3) How much water must infiltrate for the infiltration capacity to be reduced to 80 mm/h?

$80 = 20 + (110 - 20)\, e^{-1.8t}$

$\frac{2}{3} = e^{-1.8t}$

$\frac{2}{3} e^{1.8t} = 1$

$e^{1.8t} = \frac{3}{2}$

$\ln e^{1.8t} = \ln \frac{3}{2} = 0.405 \Rightarrow t = 0.225$ hour

$F = 20 \times 0.225 + \frac{(110-20)}{1.8}(1 - e^{-1.8 \times 0.225})$

$= 21.17$ mm